Apstar

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GembusHub user manual

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Revision History:

Revision	Date	Comment
001	08/06/2015	Initial Release

1. GembusHub Features

1.1 Gembus

- Control and monitor up to 400 Gemstarts
- Scan 400 Gemstarts in under 500ms
- RS485 ports x 4 for direct connection to Gemstarts
- Uses the native Gemstart protocol: Gembus
- Link speeds up to 115200
- Configuration data for all 400 Gemstarts retained through a power down
- Full support for Group Data, Configuration Data, Broadcast commands, Group Control.
- Compatible with Gemstart 1 to Gemstart 5.

1.1.1 Ethernet

- 100Mbit Ethernet Interface
- Control and Monitor via Modbus TCP/IP
- Up to 16 Modbus TCP/IP simultaneous connections
- User defined IP address ranges for attached clients

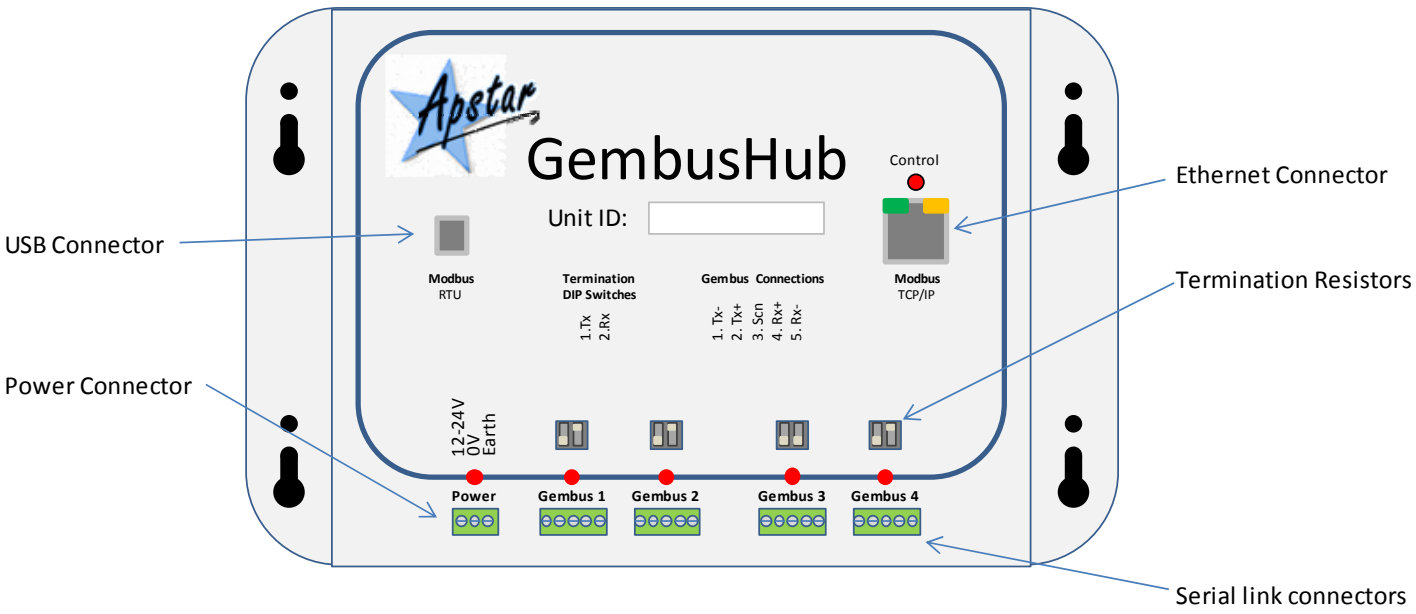
1.1.2 USB

- Serial Modbus access via the USB port.

1.1.3 GembusHub

- GembusHub configuration settings retained through a power down
- One GembusHub at each end of the link can be used with one in control and the other in standby
- Gemstart configuration via Ethernet or USB Modbus interface
- Switchable termination resistors
- Diagnostic LED indications

2.



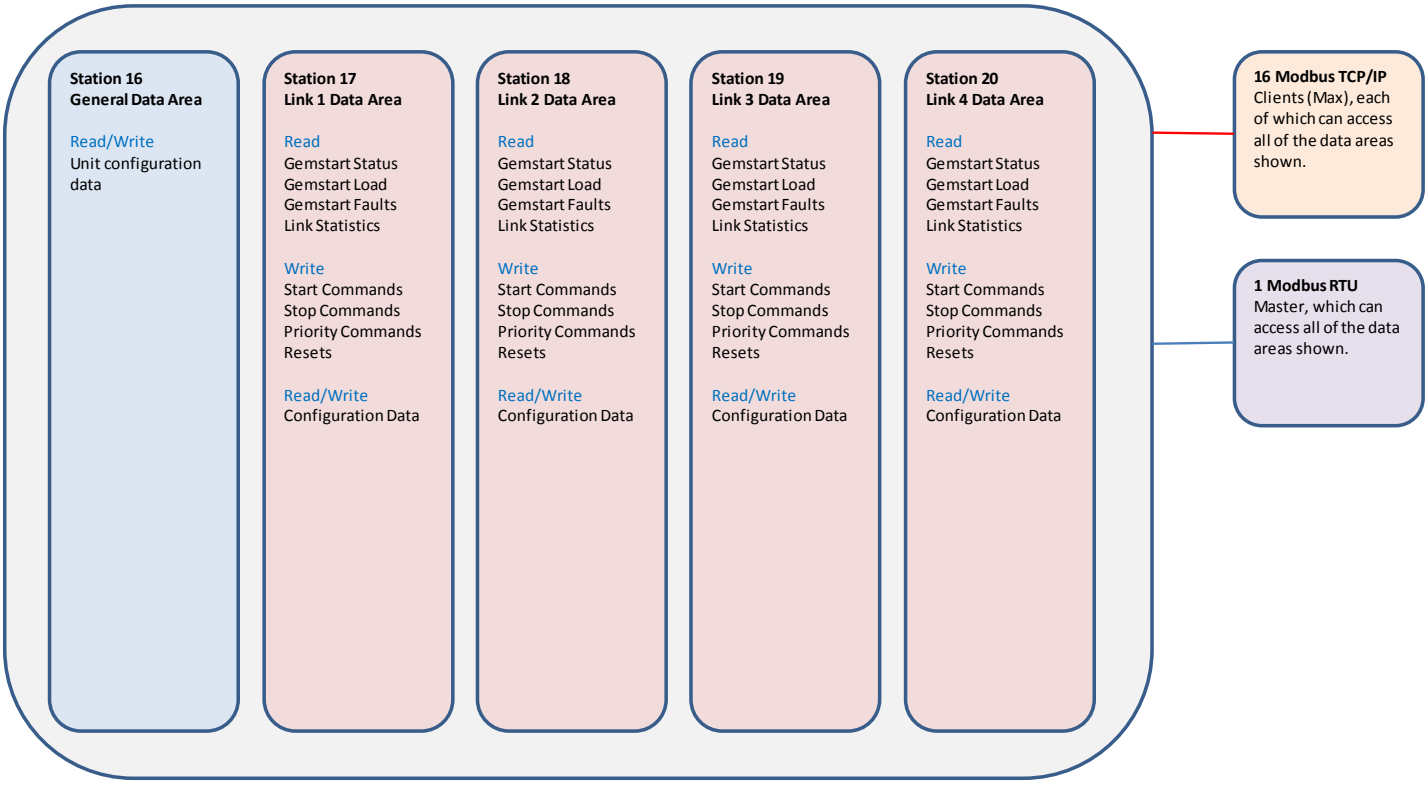
2. GembusHub Operation

The GembusHub is a fully functioning host for 4 links of Gemstarts with up to 100 Gemstarts on each link. An attached Modbus client, PLC or SCADA system, writes commands to the GembusHub which in turn are passed on to the attached Gemstarts. As the commands are sent out, the status of each Gemstart is read back into the GembusHub data map. The client system can read the status of each Gemstart at any time.

The GembusHub presents data in two main forms:

1. **General GembusHub data**. This is data that is general to the unit or to all four Gembus links. It is available to a client device which should access this data by using Modbus messages to station ID 16.
2. **Gembus link specific data**. Four identical data areas are available for clients to read and write, each one being specific to one of the four Gembus links. The client must use the following station ID's to access each area:
   Gembus Link 1: station 17
   Gembus Link 2: station 18
   Gembus Link 3: station 19
   Gembus Link 4: station 20

Please refer to the Modbus data map for full details of the data structures that are available for client access.



3. Technical Specification

PSU:	12 to 24V dc +/- 20%, 250mA
Power:	3W
Weight:	600g
Mounting:	DIN Rail or Surface Mount
Connectors:	Phoenix MC1.5 Series (3.8mm pitch) connector: 3 way for PSU
	Phoenix MC1.5 Series (3.8mm pitch) connector: 5 way for Gembus
Ethernet:	10/100Mbit RJ45
USB:	USB type B connector.
	Appears as a COM port on PC. Windows will need an .inf file for installation.
	Please download latest version from our web site.

4. Connections

Power Connector

Pin	Description
1 (left)	12V to 24V dc
2	0V
3	Earth for metal box

4.1 Gembus Connector

The up to 100 Gemstarts are connected to the GembusHub via the 4 wire RS485 link. Wire GembusHub Tx to Gemstart Rx and wire + to +, - to -.

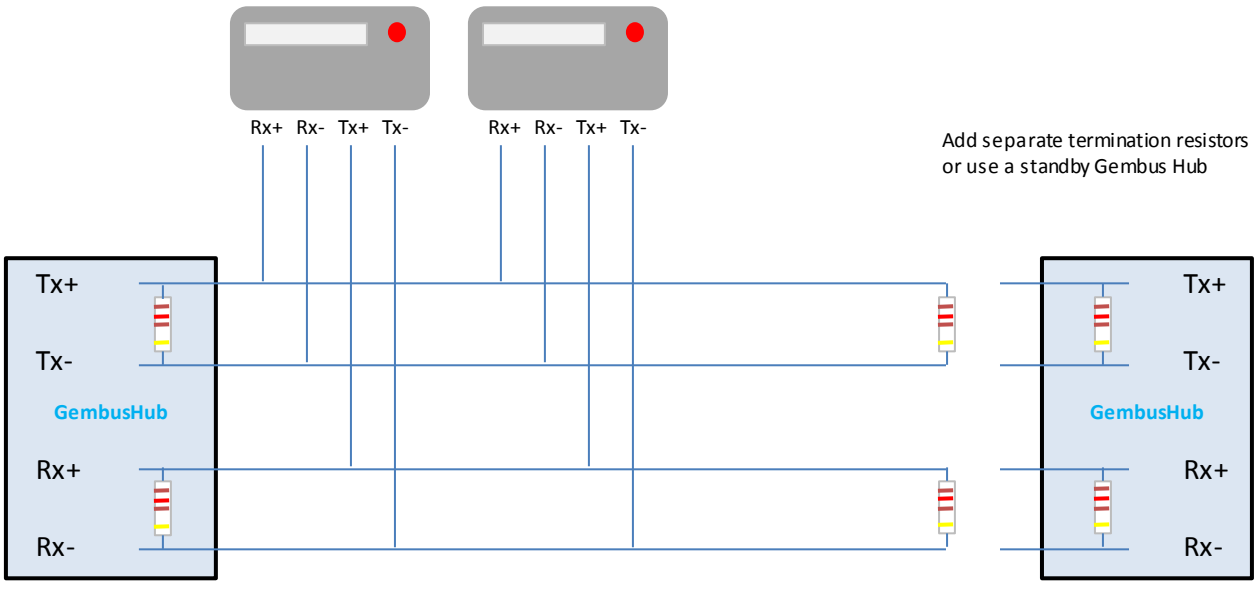
GembusHub Pin number	GembusHub Description	Gemstart Description
1 (left)	Tx-	Rx-
2	Tx+	Rx+
3	Screen	No connection
4	Rx+	Tx+
5	Rx-	Tx-

4.2 Termination

The two ends of the link should be fitted with 120ohm termination resistors. Normally the GembusHub will be fitted to one end of the link. In this case the built in termination resistors should be turned on using the front panel dip switches.

At the other end of the link from the GembusHub you should add a 120ohm termination resistor connecting Rx+ and Rx-, and another resistor connecting Tx+ and Tx-.

Historically some networks were terminated with a 220ohm resistor to reduce the loading. Only use this if the 120ohm resistor causes communication errors.



4.3 Standby Operation

On higher security installations a second GembusHub can be added to the link to provide a backup system. The best place to fit this is at the other end of the link from the primary GembusHub. This way the built in termination resistors can be turned on.

When using two GembusHubs in the same link only one of the Hubs can be enabled at any one time. Set the Link Control register to 1 or 2 to enable transmission. The other GembusHub Link Control should be set to 0 to disable transmissions.

In standby mode (Link Control set to 0) the Link Status register (512 or 1101) is still updated on the basis that if any data is received then another GembusHub must be talking to the Gemstarts to generate a reply. If no Gemstart replies are seen for 2s then the status flag is cleared to 0.

5. LED indications

5.1 PSU LED

LED	Description
Off	No power
2 Red flashes	Power from USB only. No Gembus functionality
Slow g-y-r cycle	USB connected (GembusHub powered from 12-24V supply)
Green On	Healthy

5.2 Gembus LEDs

LED	Description
Off	Link disabled (no transmissions). Not receiving any data which suggests nothing is communicating with any Gemstart OR running on USB power only which does not support Gemstart comms
2 Green Flashes	Link disabled (no transmissions). Still receiving data which suggests another GembusHub is communicating to the Gemstarts.
Red On	Transmitting and no Gemstarts in the scan range are replying
Yellow On	Transmitting and some Gemstarts in the scan range are replying
Green On	Transmitting and all Gemstarts in the scan range are replying
Slow Green Flash	*Gemstart Simulator is seeing valid messages replying*
Slow Red Flash	*Gemstart Simulator configured but is not seeing any valid messages*

5.3 Network LED

LED	Description
Off	IP Hardware not initialised yet
2 Red flashes	Not seen the network yet (cable not plugged in since power on)
3 Red flashes	Network cable removed (cable was plugged in but now removed)
4 Red flashes	DHCP not found
5 Red flashes	IP address not allocated
2 Yellow flashes	No Modbus messages within timeout period
Green	Receiving Modbus messages within timeout period

5.4 Network Connector

Left LED	Description
Off	No link
Green	Good link

Right LED	Description
Off	No activity
Yellow	Link Activity (NB Not necessarily to this device)

5.5 LED Testing

Register 207 can be used to test all 8 LEDs without affecting the functionality of GembusHub. To test write the following values in to register 4x207:

Value	Result
0	Testing not active, normal operation results.
1	All six status LEDs are switched to green
2	All six status LEDs are switched to red
3	All six status LEDs are switched to yellow
4	All six status LEDs are switched to cycle through colours

6. Control Timing

The time it takes for a command to be actioned and confirmed is dependant on a number of factors.

Reference	Description
Command Update time	This is the time it takes the SCADA system to get round to sending the new command. This is under the control of the SCADA system.
Modbus TCP/IP time	In tests up to 400 Modbus TCP/IP messages can be processed per second by the GembusHub. So factor in a delay of around 2ms to actually send the Modbus TCP/IP message.
Gemstart Slot time	This is the time it takes for the GembusHub to send a message and get a reply from one Gemstart. This depends on the size of the message. See the table below for example Gemstart Slot times.
Command Broadcast time	The fastest way to get the new command out to the Gemstart is to enable Broadcast Mode. If this is enabled then the longest time possible is 2 Gemstart Slots (see above)
Gemstart Action Delay	This is the time it takes for the Gemstart to react to the broadcast or standard command once it has received it. Less than 5ms.
Contactor Open/Close Delay	The reaction time of the contactor. Typically this is 13 to 20ms
Gemstart Detection Delay	The time for Gemstart to detect that the contactor has opened. Typically this is 20ms
GembusHub Scan Time	The time it takes for the GembusHub to read back that the contactor has closed. This is probably the longest delay in the sequence and is equal to the scan time for the link. The scan time is equal to the number of Gemstarts in the scan plus 1, times the slot time.
SCADA poll delay	The time between reads performed by the SCADA system

6.1 Gemstart Slot and Scan Times

The times are the milliseconds per Gemstart in the scan range. Ie for a scan of 0 to 99 multiply these figures by 100. To calculate the scan time add 1 to the number of Gemstarts in the scan and multiply it by the Gemstart Slot time. Eg for a scan range of 100 Gemstarts at 19200 and normal status then the scan time will be about (100 + 1) * 4.2 = 424ms

Gemstart Slot times in ms.

	Control Code	Number of Registers read	9600	19200	38400	57600	115200
Normal Status	0	2	8.5ms	4.2ms	2.2ms	1.5ms	0.8ms
Short Status	1	1	6.4ms	3.2ms	1.6ms	1.1ms	0.6ms
Long Status	2	3	10.6ms	5.3ms	2.7ms	1.8ms	0.9ms
G10 Status	3	8	22.0ms	11.0ms	5.5ms	3.7ms	1.9ms

6.1.1 Example

For G10 Status from 100 Gemstarts at 19200 the send and confirm time is:

Modbus + Gembus Broadcast + Action Delay + Contactor Time + Detection Delay + Scan Time

= 2 + 2*11 + 5 + 15 + 20 + 101*11

= 1175ms

This can be improved by using a faster baud rate, smaller scan range or smaller status message.

7. USB

The USB port allows local access to the GembusHub data map. The port can also be used to see diagnostic information generated by GembusHub. See the Data Map document for a description of how to access the diagnostic data.

7.1 USB Installation

Connect the GembusHub to the PC using the USB connector. If the PC tries to install the driver then point it to the relevant inf file which can be found in https://www.dropbox.com/sh/anng3leype1n2wx/AAD-TeEGRr1-p7hdpiirwROna?dl=0 and follow the installation instructions.

Once installed look in the Device Manager / Ports section to see which com port has been allocated to "Apstar GembusHub Win*X* Driver".

8. USB Diagnostics

Text based debug and diagnostics messages can be accessed via the USB port. These messages can be "turned on" from a windows terminal program (such as SimpleDiagnostics) by typing a question mark - ?. Disconnecting the Terminal Window and connecting to a Modbus terminal again will disable the diagnostics.

This is essential information to locate any problems that may arrive. Make sure the Modbus driver and the reprogramming application are not connected to the USB port.

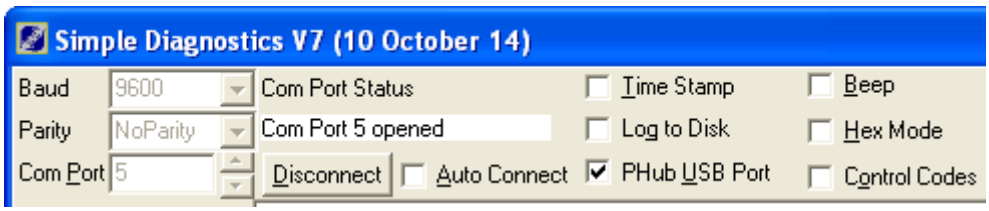
Get SimpleDiagnostics from the dropbox:
https://www.dropbox.com/sh/anng3leype1n2wx/AAD-TeEGRr1-p7hdpiirwROna?dl=0
Start it up and set the com port to that allocated to the "Apstar GembusHub Win*X* Driver".

Set GembusHub USB Port checkbox on.

Click Connect.

Useful options are:

- Timestamp
- Log to Disk
- Auto Connect



Once Simple diagnostics has connected to the GembusHub, enter "?" without the quotes and enter. This enables the diagnostics. Up to 8K of diagnostics history will be downloaded. Sometimes you have to enter the ? twice.

9. Reprogramming

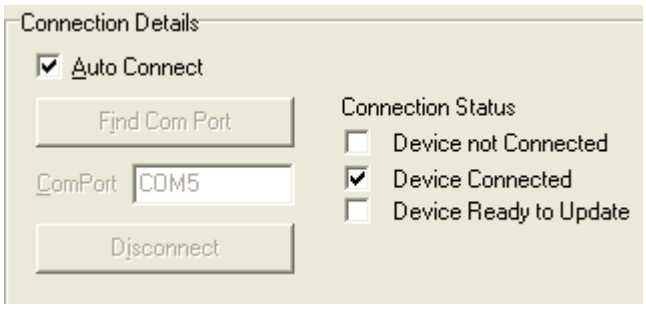
Make sure you have disconnected your Modbus application and that Simple Diagnostics is also disconnected from the USB port.

Get the latest GHubV1-60-xx-xx.exe file from Apstar.

Run the exe file

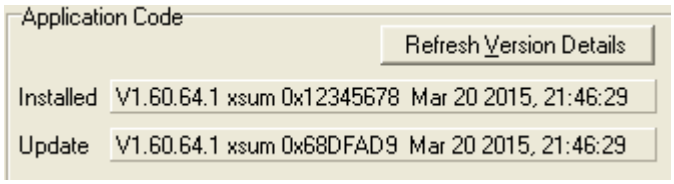
Device Connected

If it doesn't say it's connected then double check nothing else is connected to the GembusHub



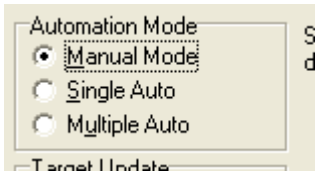
Version Info

It tells you which version is in the device and which version you are about to reprogram it with.



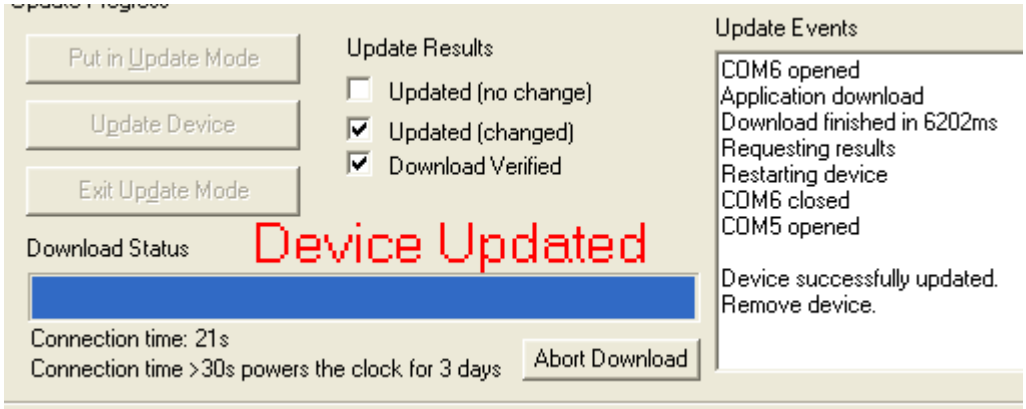
Update GembusHub

Click Single Auto



Wait for Completion

Once the Device Updated text appears the device has been updated.



Disconnect the USB lead and the update program will auto close.

10. Remote Reboot

Sometimes it is useful to be able to remotely reset the GembusHub, eg after changing the Modbus TCP/IP Port setting which is only used during startup. A remote reboot can be actioned by writing “REBOOT” to the time setting registers with a single multi register write to 6 registers ie

Write Address:	100	
Write Length:	6 registers	
Register 100:	82	(Ascii R)
Register 101:	69	(Ascii E)
Register 102:	66	(Ascii B)
Register 103:	79	(Ascii O)
Register 104:	79	(Ascii O)
Register 105:	84	(Ascii T)

There will be no reply to this message and the GembusHub will immediately reboot. Comms to the Gemstarts will stop for about 2.7s.